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Thermo/Soluto-capillary instabilities in 3D bi-component liquid pools using DNS[1] ADAM WILLIAMS, The University of Edinburgh, PEDRO SAENZ, MIT, PRASHANT VALLURI, KHELLIL SEFIANE, The University of Edinburgh — The behaviour of surface tension dominated flows in the presence of a temperature gradient and phase change is of great importance in designing micro-cooling devices. While evaporating pools and droplets have been investigated numerically and experimentally, these studies have dealt only with pure fluids. For bicomponent liquid mixtures, limited experimental studies have been conducted but a rigorous numerical model is absent. We present a two-phase multicomponent DNS model to simulate thermo/soluto-capillary instabilities in bicomponent liquid layers subject to a horizontal temperature gradient. The strategy fully accounts for a deformable interface using a variant of volume-of-fluid method. The presence of a second component introduces thermophoresis in the liquid phase which then gives rise to solutal Marangoni effects. By combining mixture thermodynamics with multiphase DNS, we investigate thermo/soluto-capillary and interfacial instabilities of a 3D bicomponent liquid pool. An important aspect we quantify is the strength of solutal over thermal Marangoni convection and its effect on stability of resultant interfacial waves and phase-separation in the liquid. The model is robust enough to include phase-change and the advection-diffusion of volatile species in the gas phase.

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